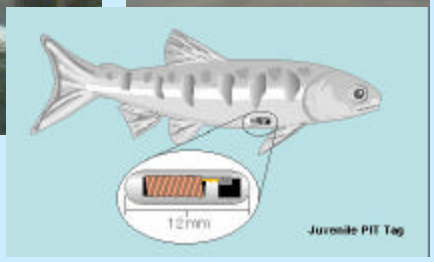
PIT Tagging of Chinook Salmon Juveniles in the Lake Washington Basin

Summary of 2000-2002 Study Results

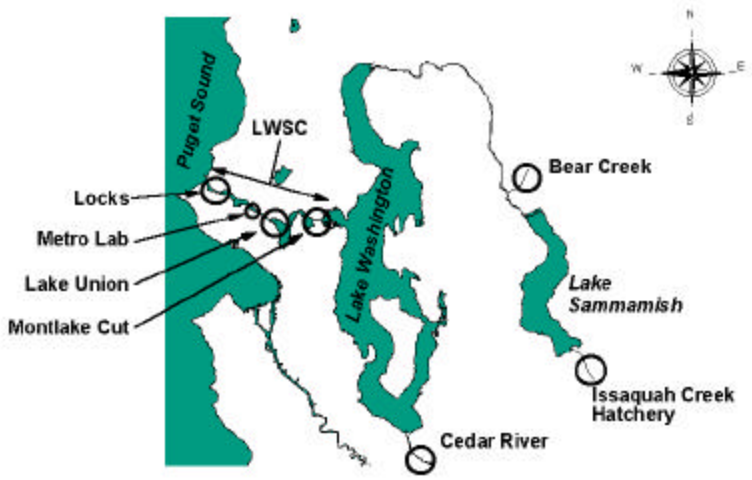
Paul DeVries

(Also: Fred Goetz, Kurt Fresh, Dave Seiler, Chuck Ebel, Steve Achord, Lindsey Fleischer, and countless others….)

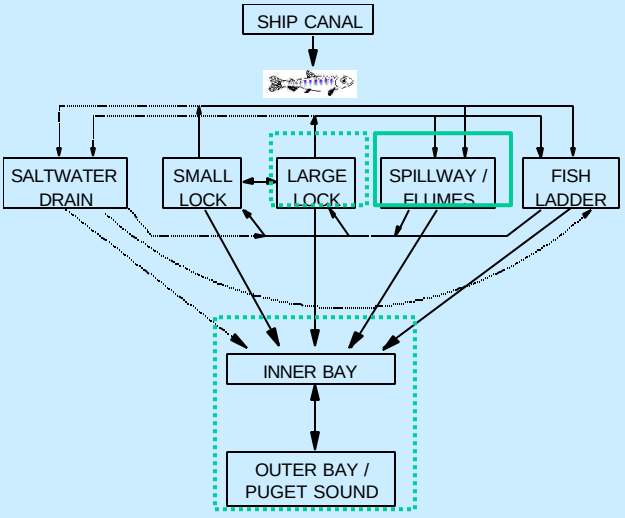
PIT Tag Detection



Release Sites



Migration Routes Through Lake Washington Ship Canal

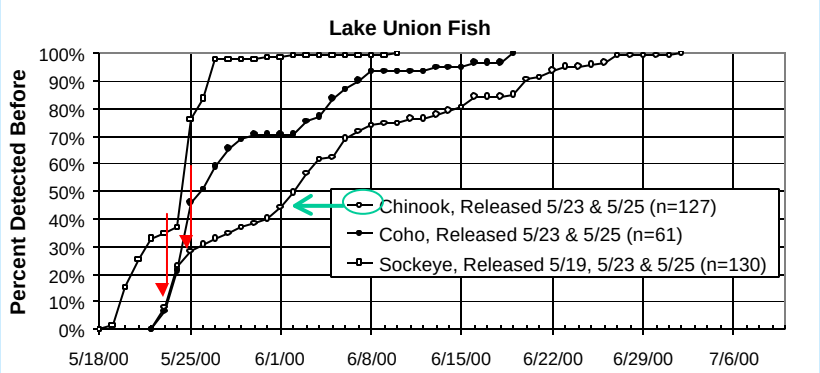


Information From PIT Tagging:

- **Seasonal Timing of Passage in LWSC**
- **Diurnal Timing of Passage at Locks**
- **Migration Rates Through LWSC**
- **Size-Specific Characteristics**
- **Detection Rates of Outmigrants in LWSC**
- **Passage Behavior at Locks / in Estuary**
- **Differences/Similarities Between Species**
- **Relation to LWSC Environment**
- **Water Use**

Migration/Passage Timing

Chinook Migration Timing: 2000 Detections



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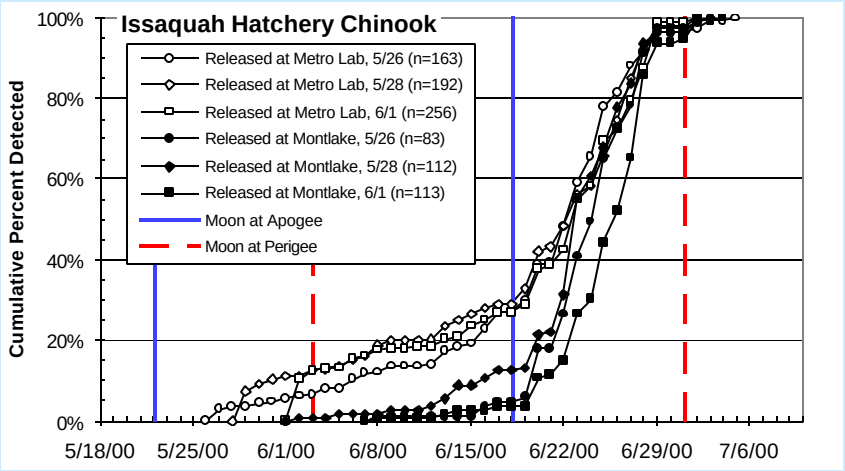

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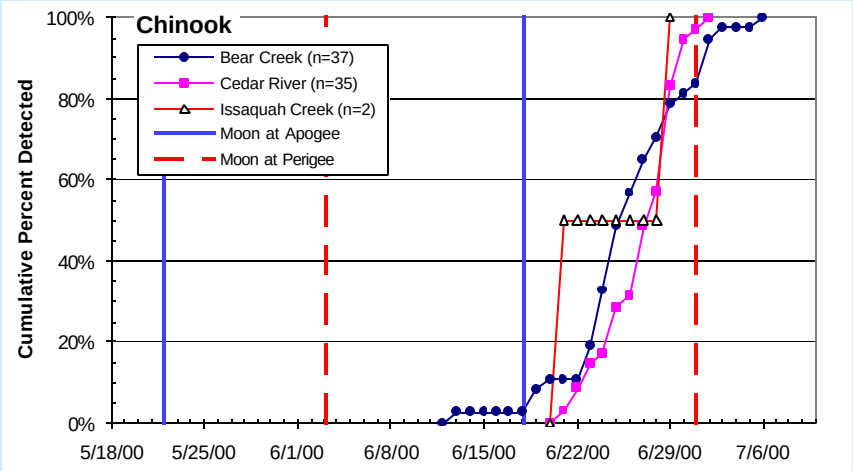

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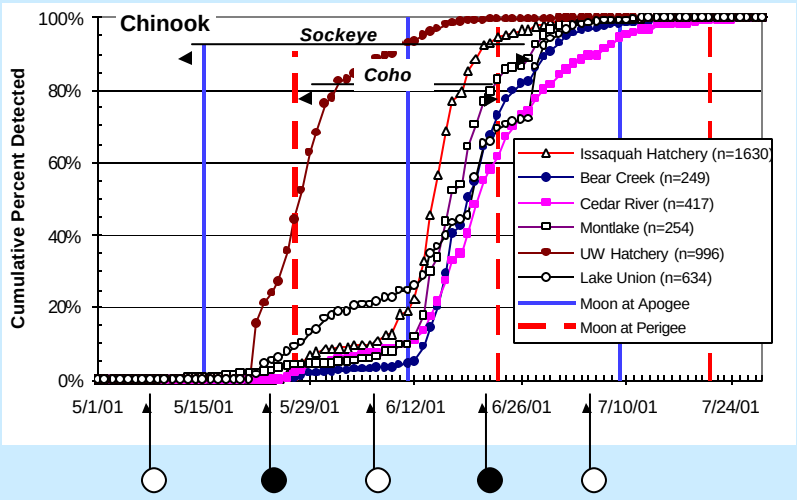
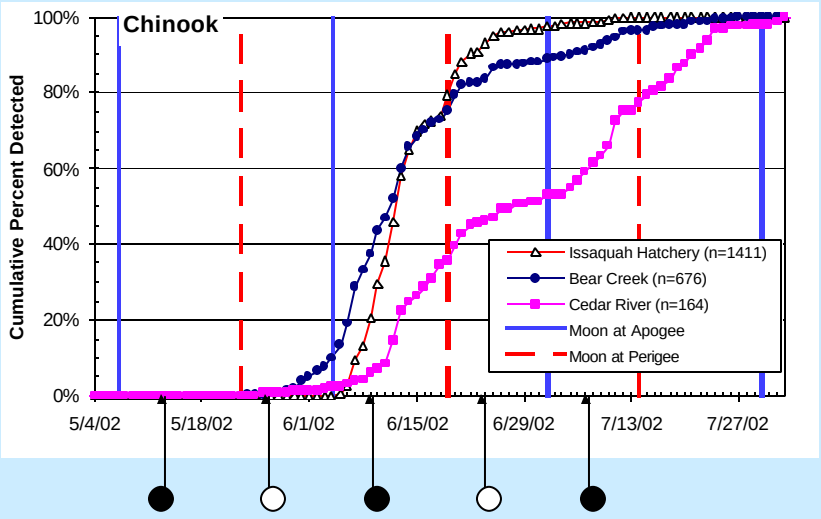
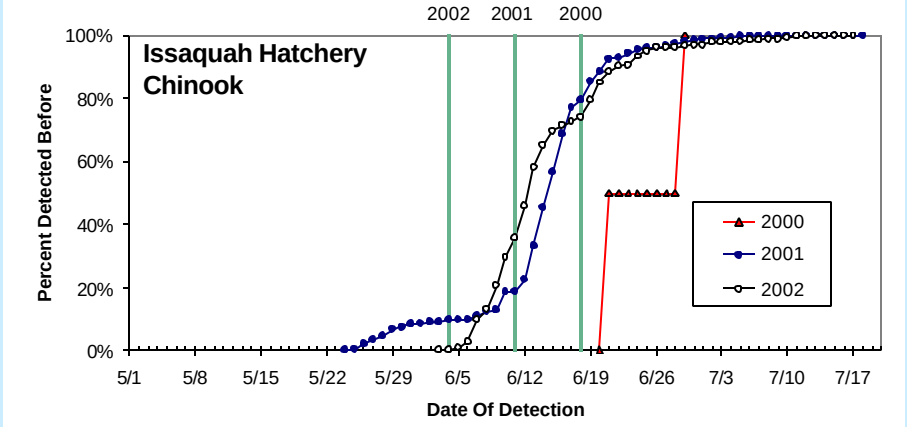


Chinook Migration Timing: 2002 Detections



Chinook Migration Timing: 2000-2002



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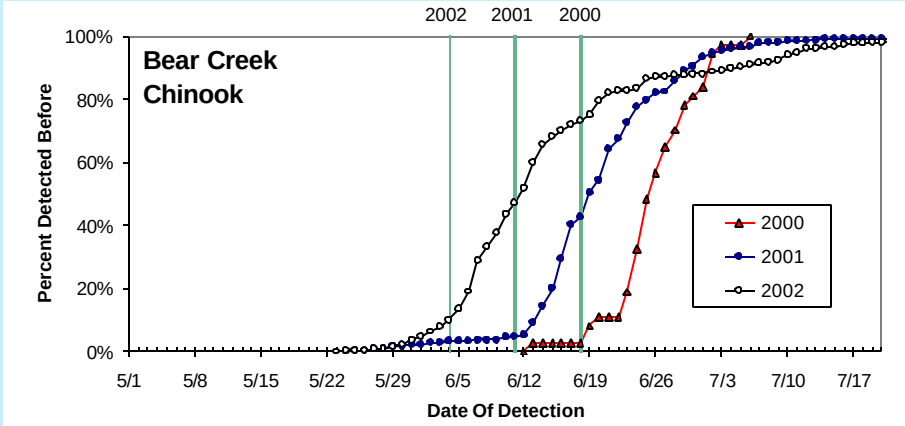
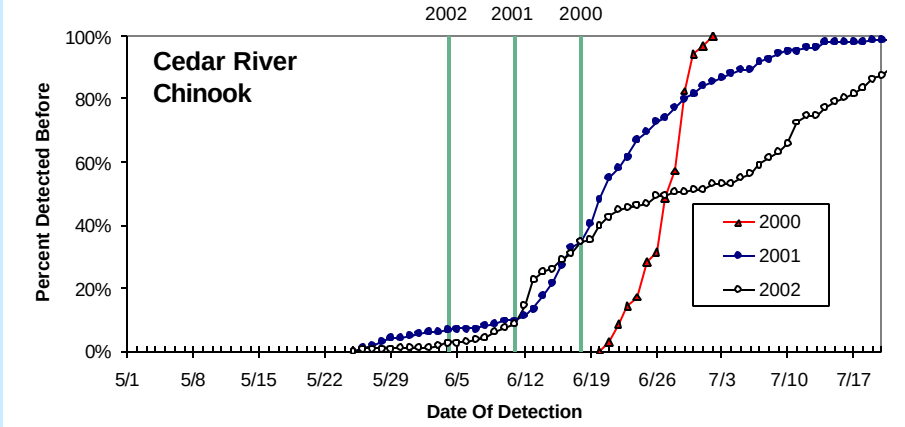
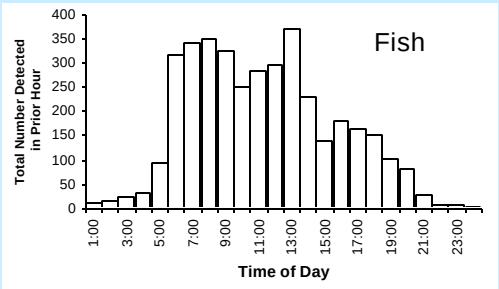
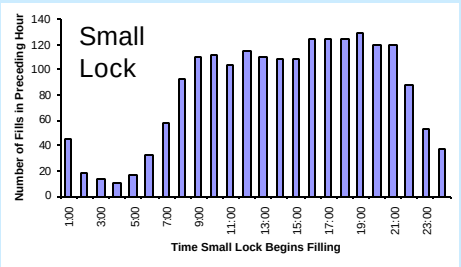


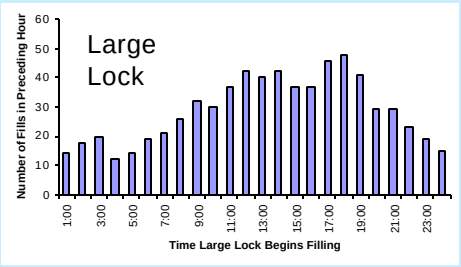
Chinook Migration Timing: 2000-2002



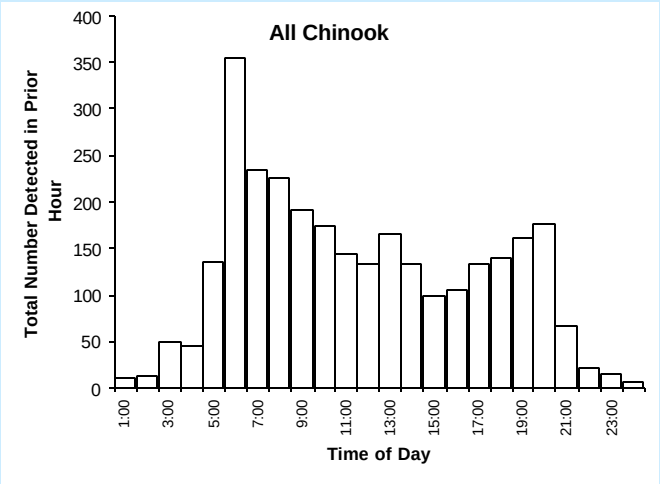
Chinook Passage Timing: 2001





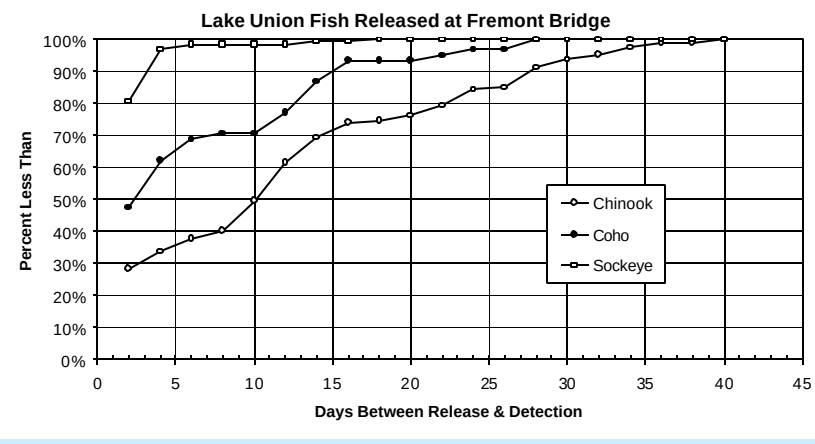


Chinook Passage Timing: 2002

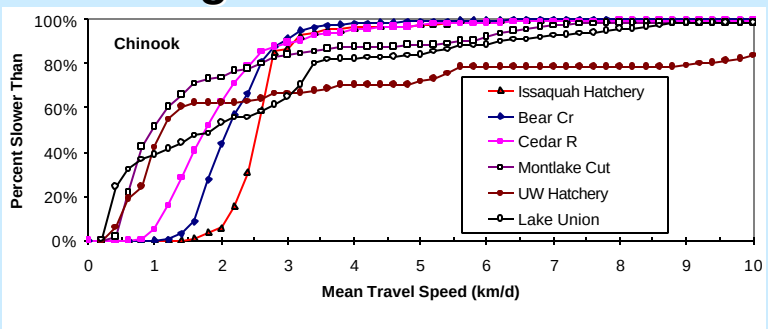


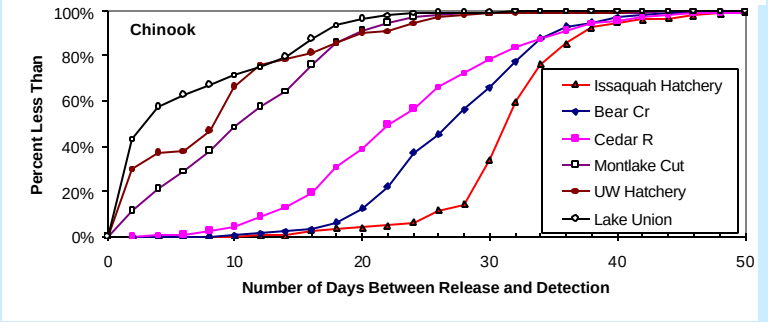
Migration Rate

Chinook Migration Rate: 2000

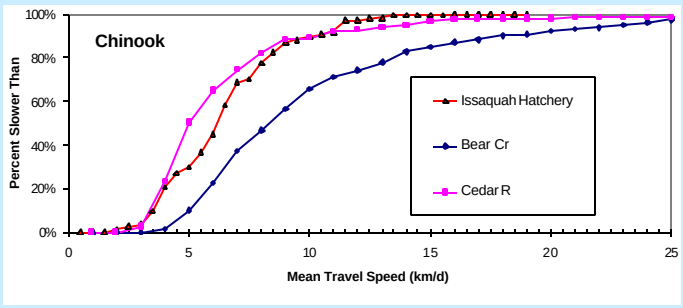


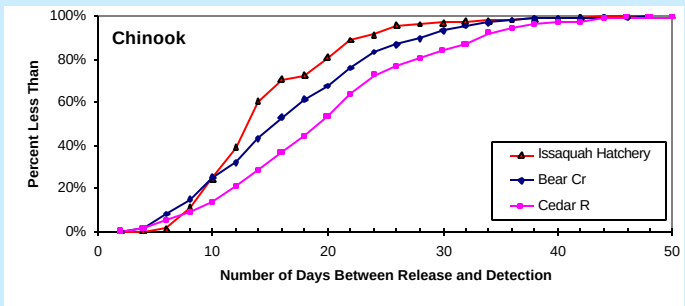
Migration Rate: 2001



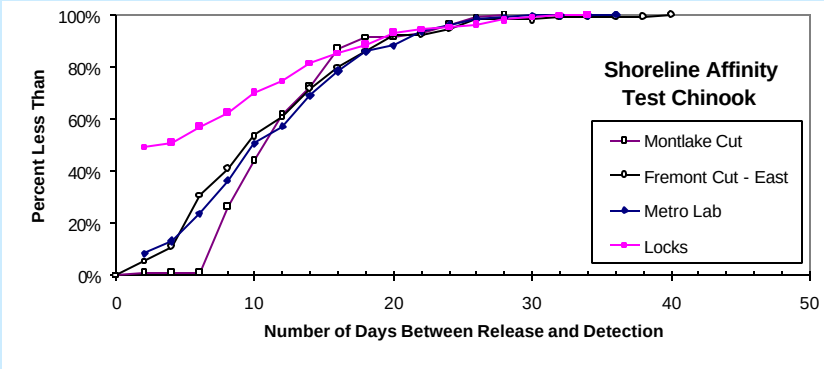


Migration Rate: 2002



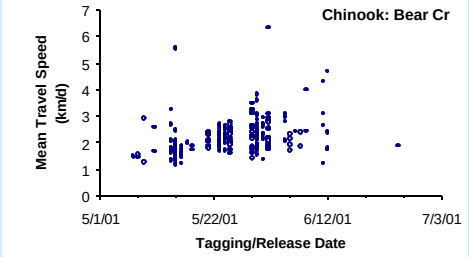


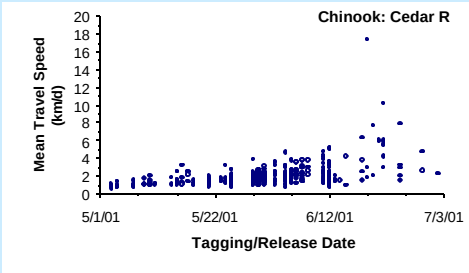
Migration Rate: 2002



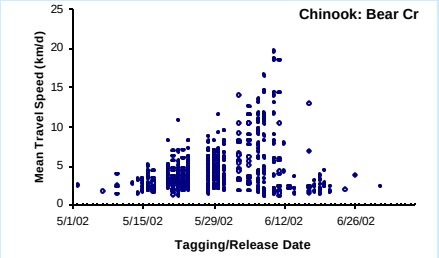
Migration Rate:

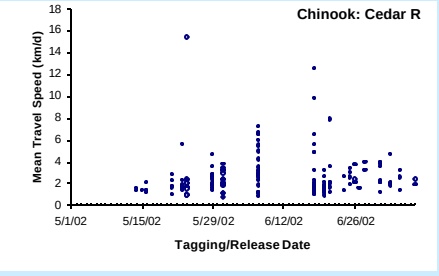
2001



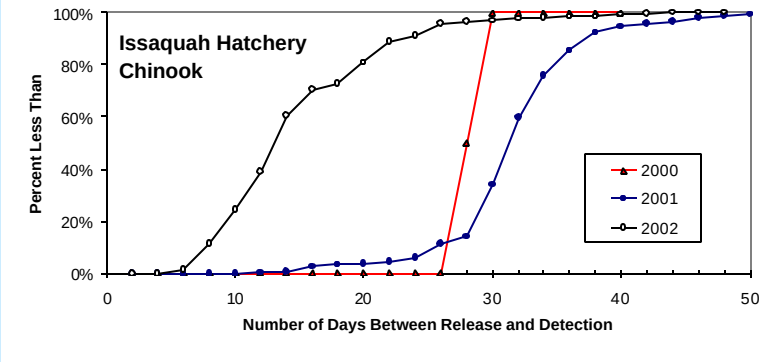


2002

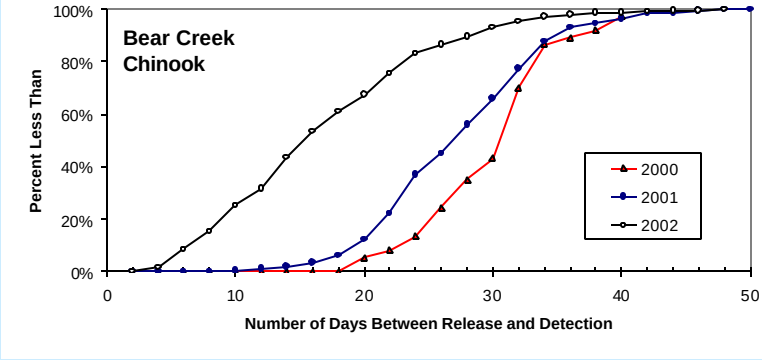




Migration Rate: 2000-2002



Migration Rate: 2000-2002



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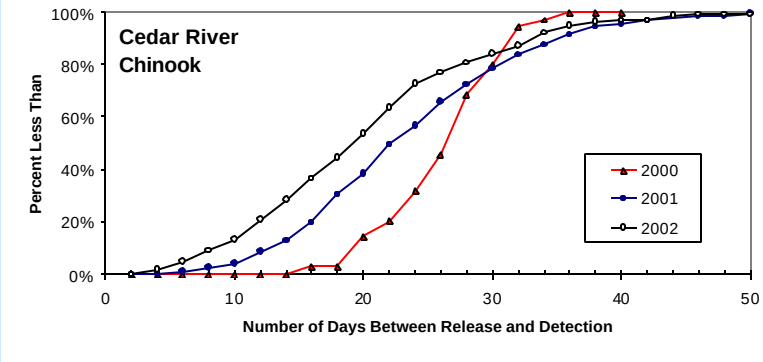
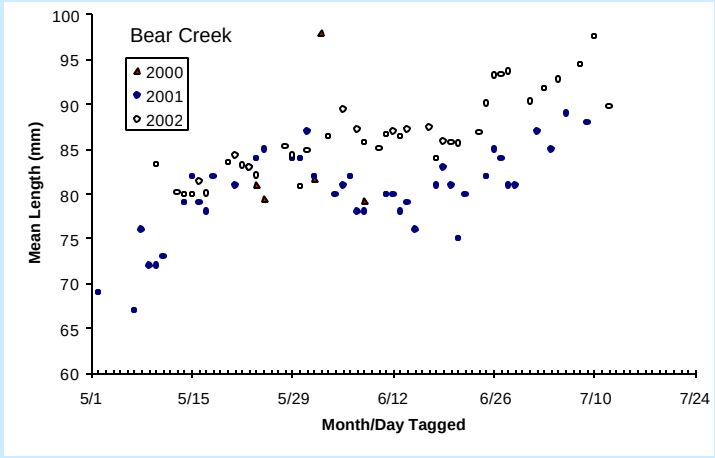
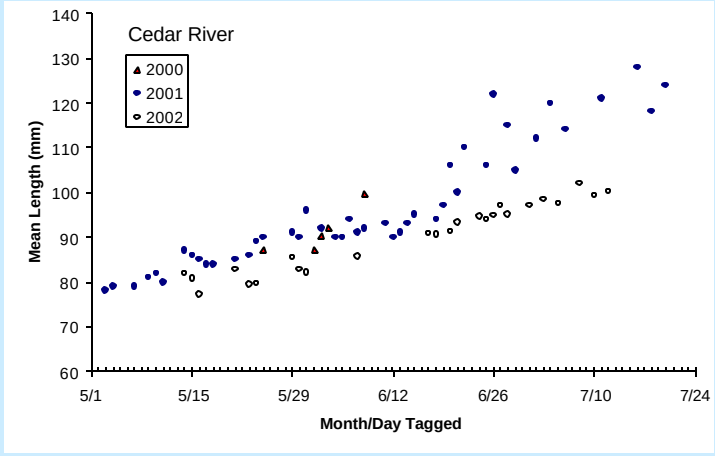


Size-Specific Characteristics:
Timing/Residualization

Chinook Lengths: 2000-2002



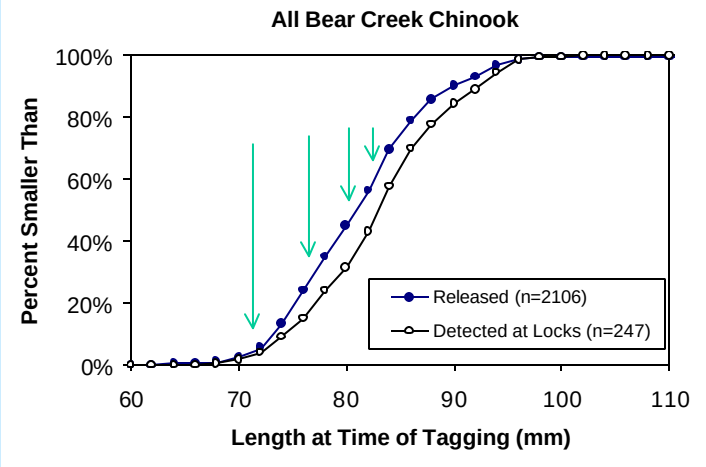
Chinook Lengths: 2000-2002



Natural Chinook Residualizing in Lake Washington System:

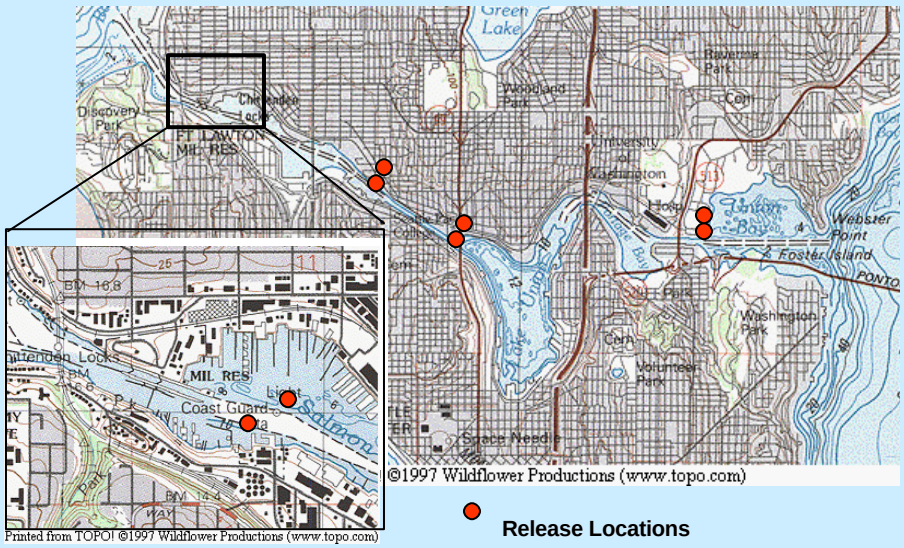
Tagging			Flume Detection		Interval
Length (mm)	Location	Date	Date	Time	(Days)
87	Issaquah Cr Trap	6/7/00	6/3/02	14:10	726
76	Bear Creek	5/15/01	5/17/02	11:33	367
80	"	6/5/01	5/5/02	15:00	334
82	"	6/12/01	5/7/02	14:28	329
71	"	6/21/01	5/12/02	10:57	325
85	Cedar River	6/11/01	5/25/02	18:12	348

Residualized Fish Were From Smaller Half of Size Distribution:

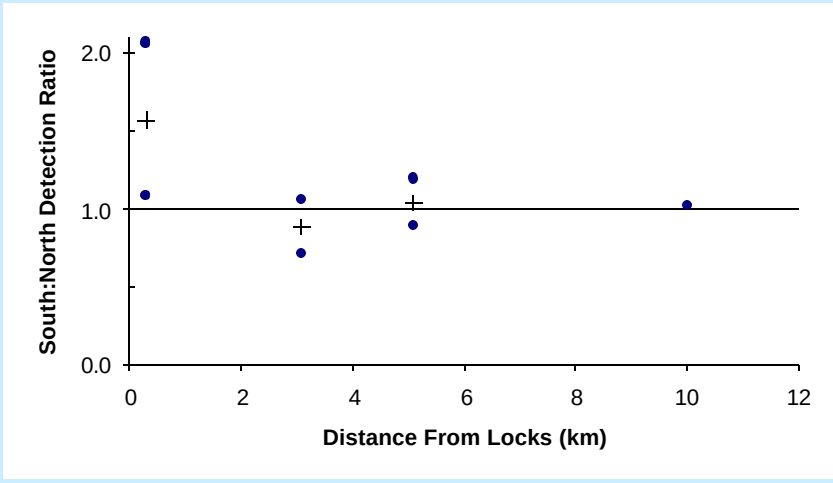


Behavior in LWSC

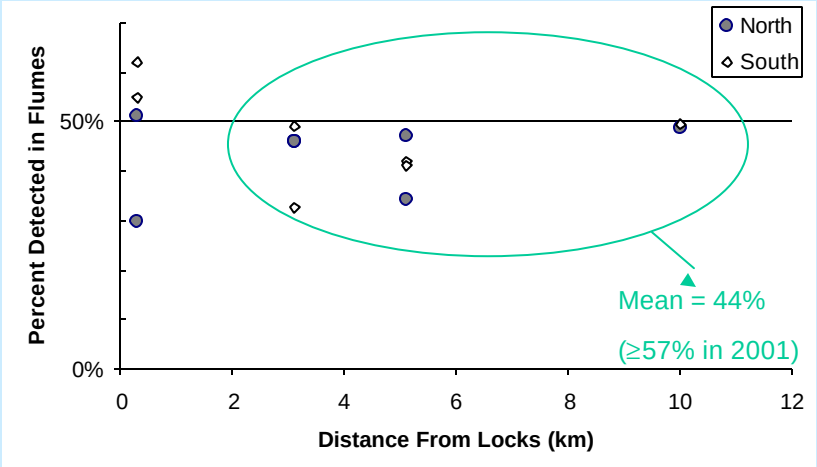
Do Chinook Outmigrants Show Affinity to One Shoreline in LWSC?



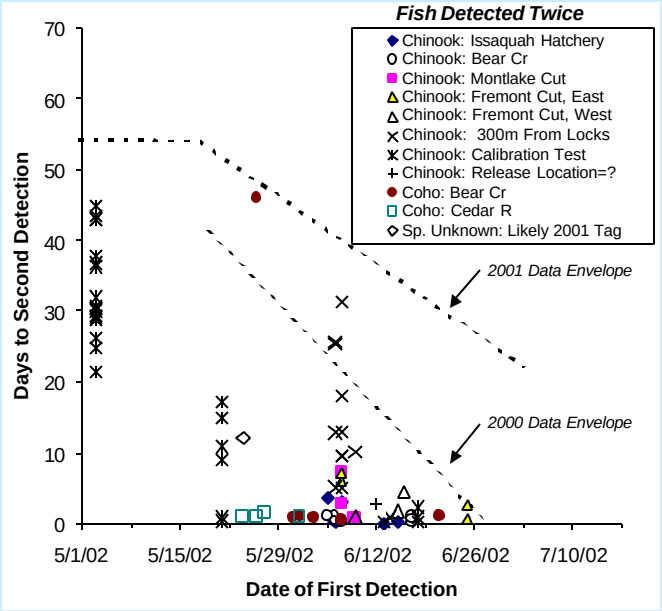
2002 Study Result Suggests Chinook Have no Shoreline Affinity in LWSC



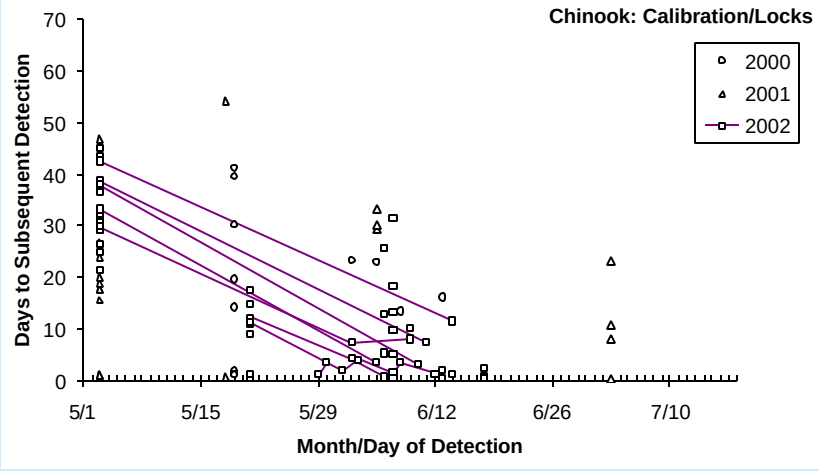
Study Result Suggests Proportion Using Flumes



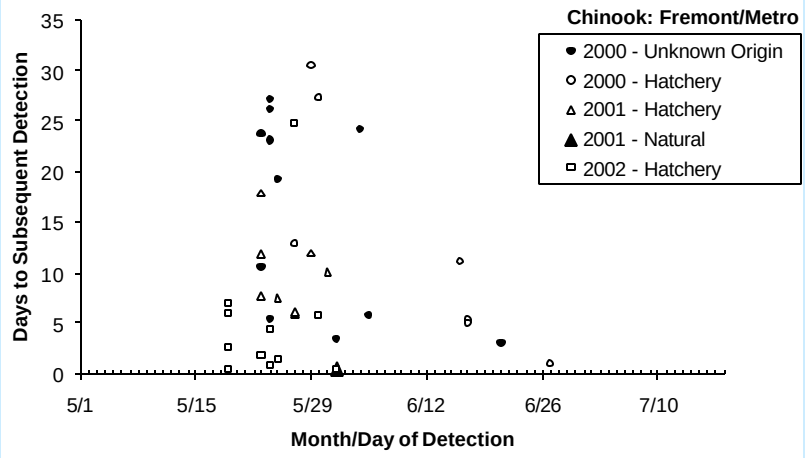
Recycling at the Locks: 2002



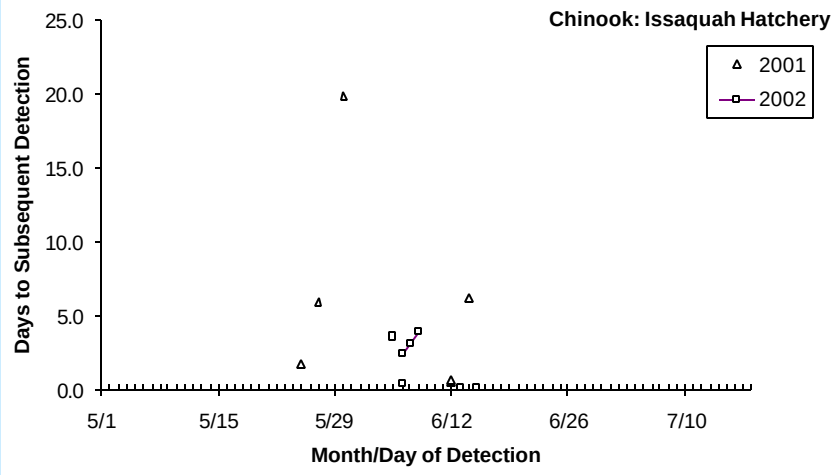
Recycling: 2000-2002



Recycling: 2000-2002



Recycling: 2000-2002



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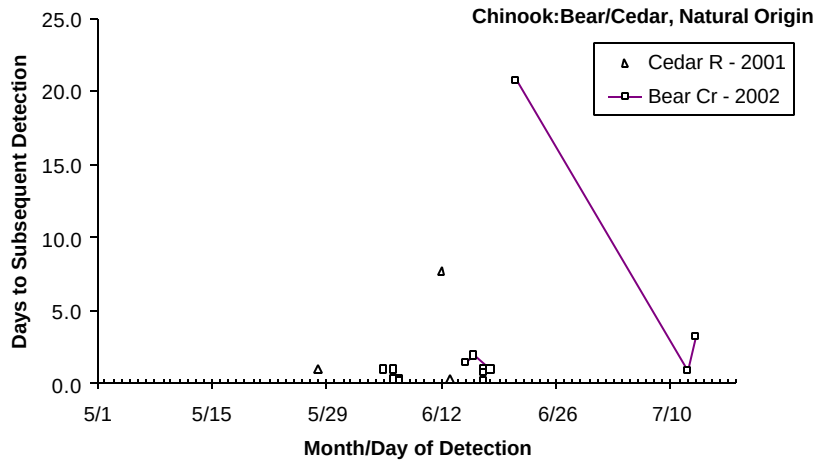
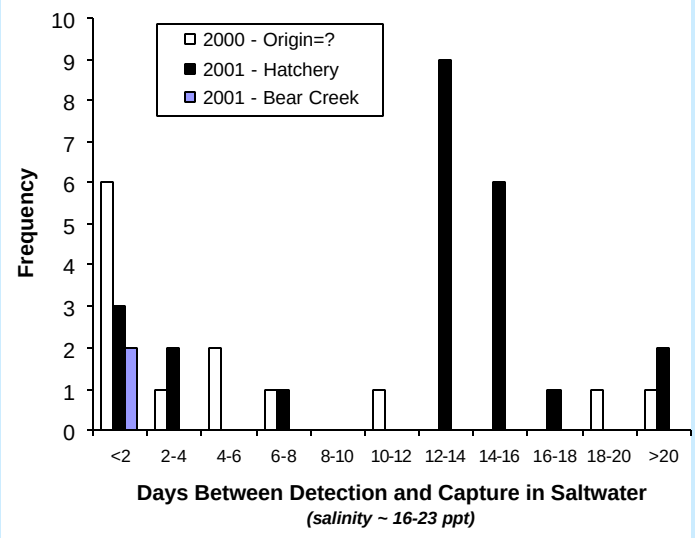
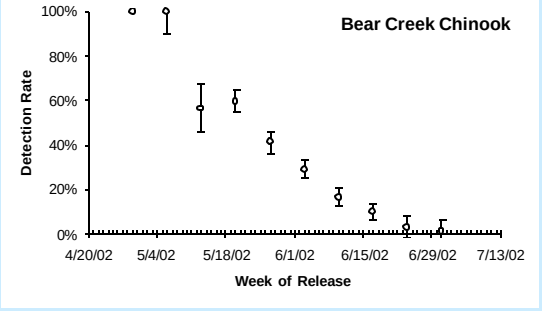


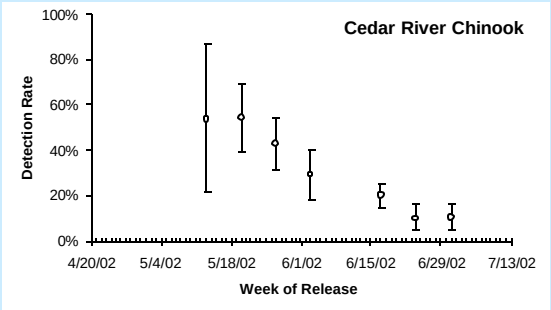
Inner Bay Saltwater Residence



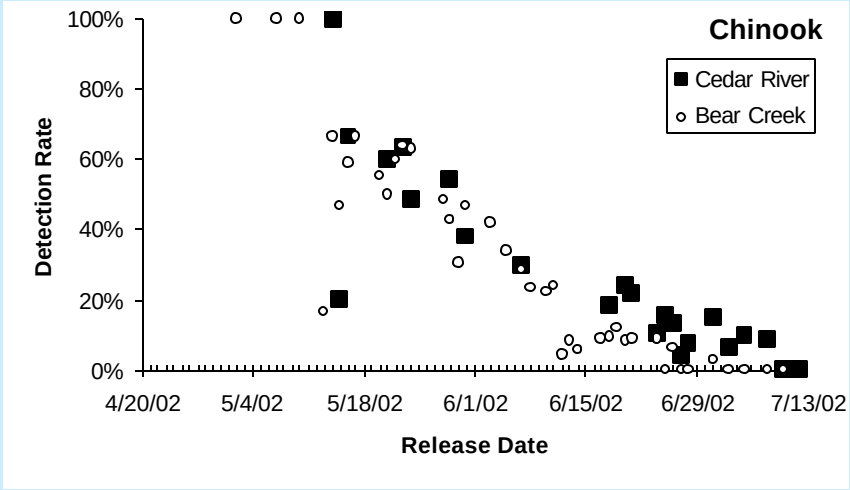
Detection Rates

Weekly Detection Rates: 2002

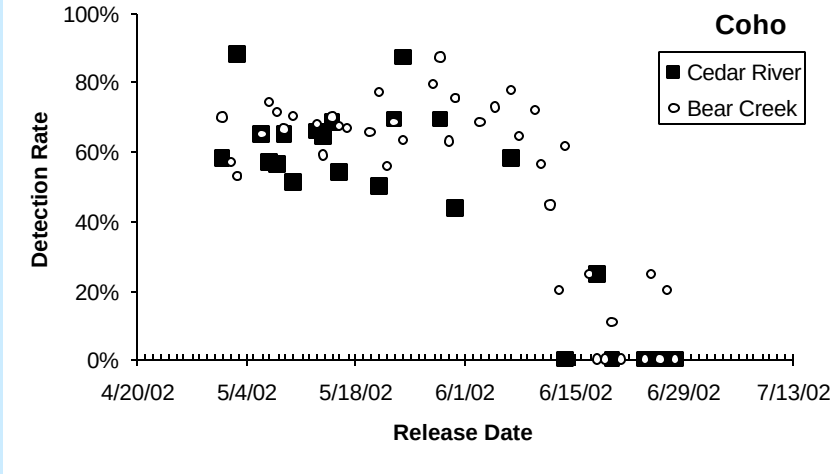




Detection Rates: 2002



Detection Rates: 2002



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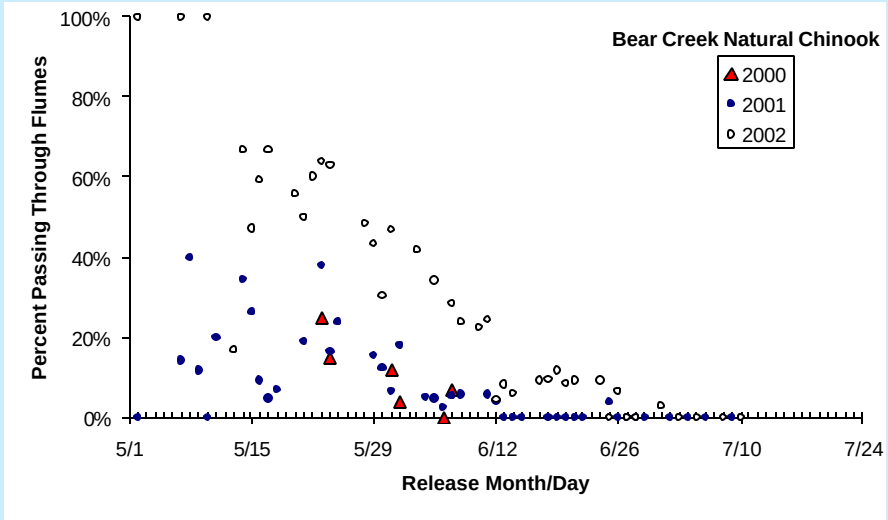
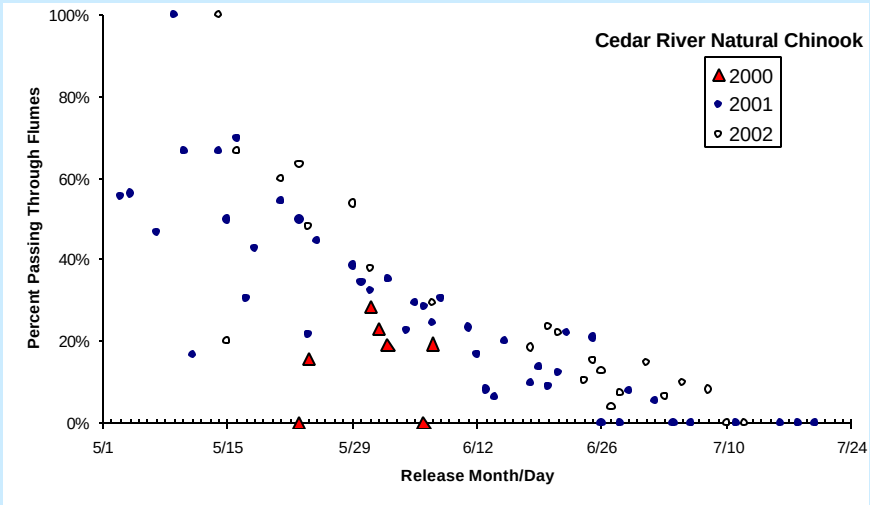


Detection Rates: 2000-2002



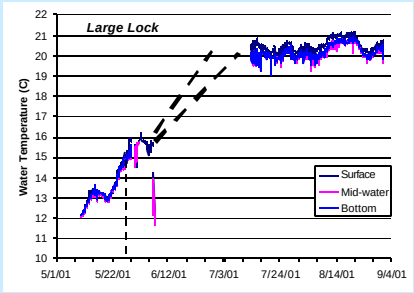
Issaquah Hatchery Detection Rates

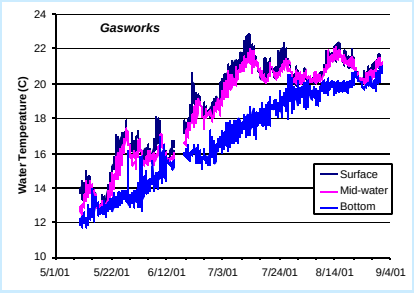
2000	**1.2%**
2001	**37.7%**
2002	**39.0%**

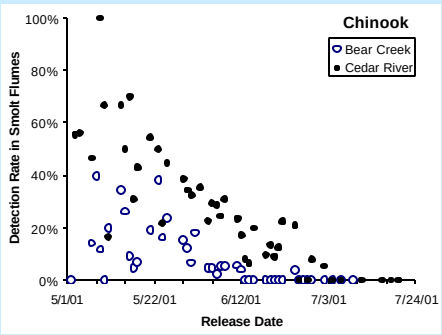
(adjusted for detection efficiency)

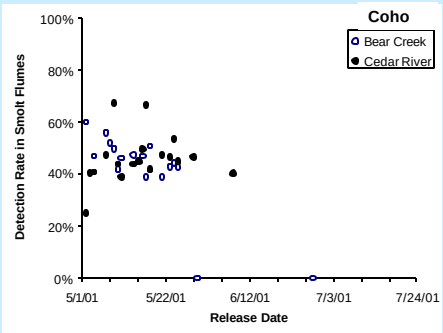
Environmental Conditions in LWSC
(Temperature)

Water Temperatures in 2001

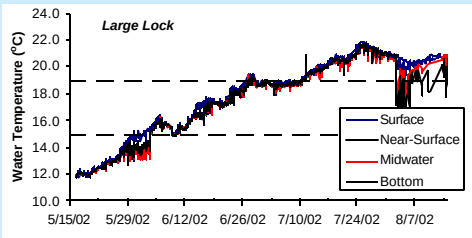


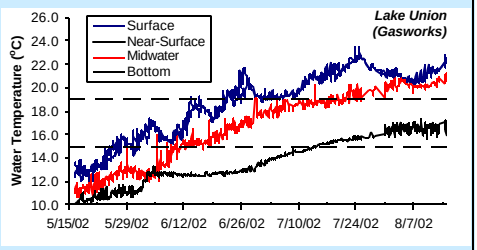


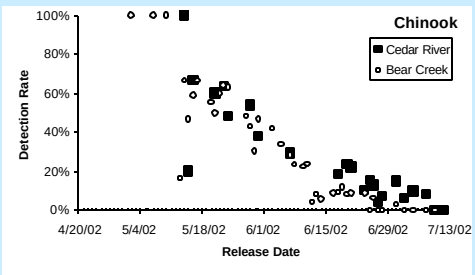


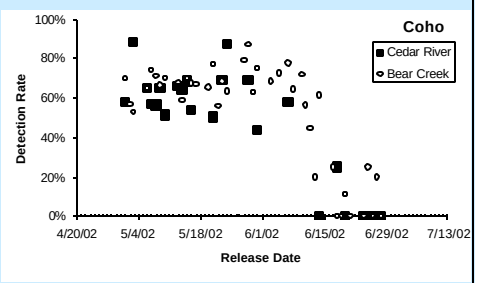


Water Temperatures in 2002

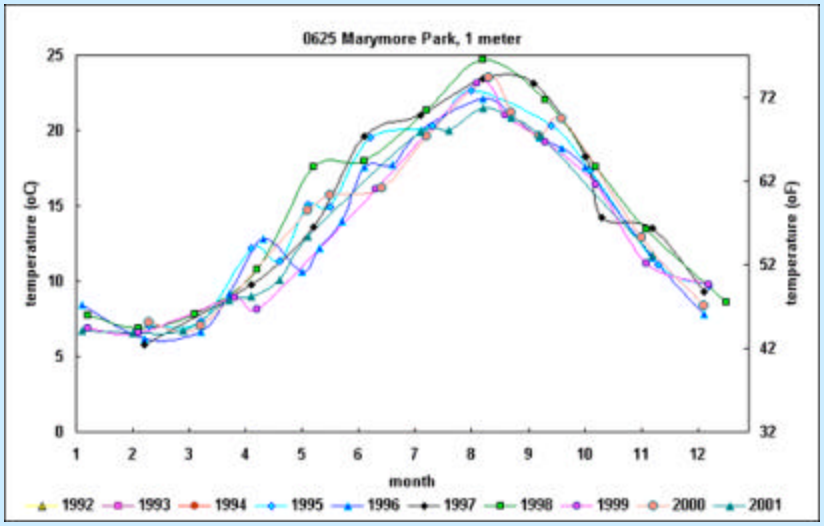




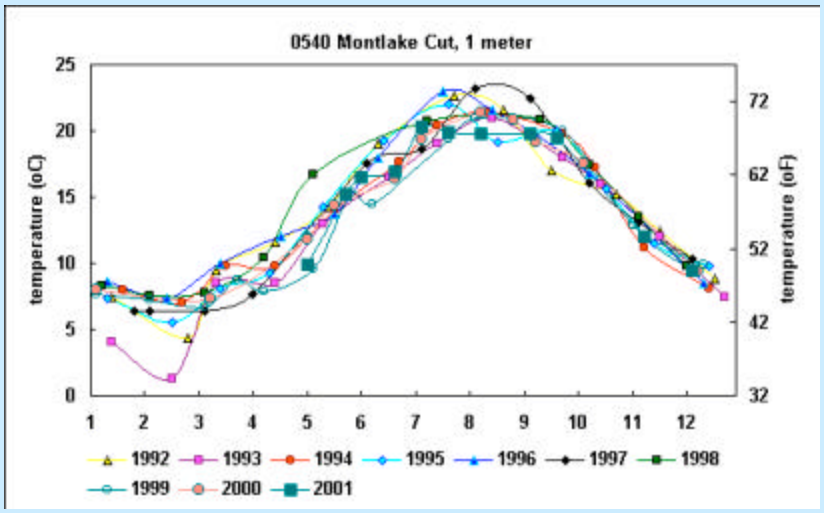




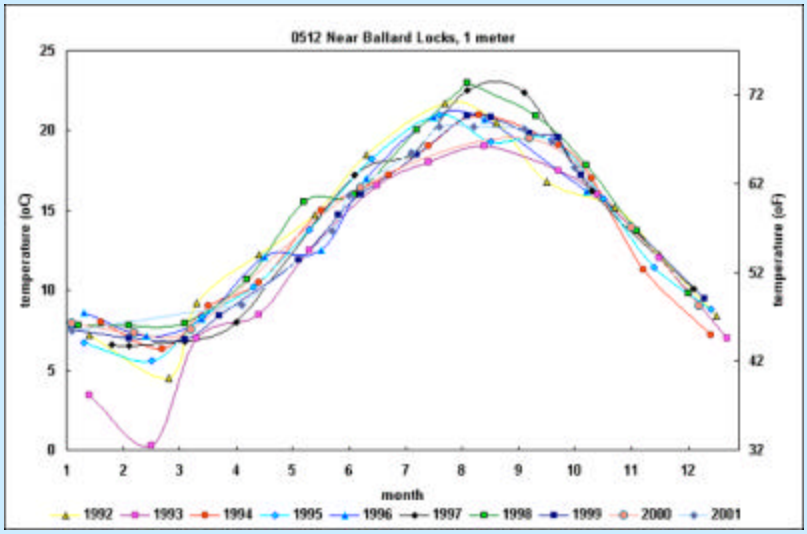
Surface Water Temperatures: Lake Sammamish



Surface Water Temperatures: Montlake Cut



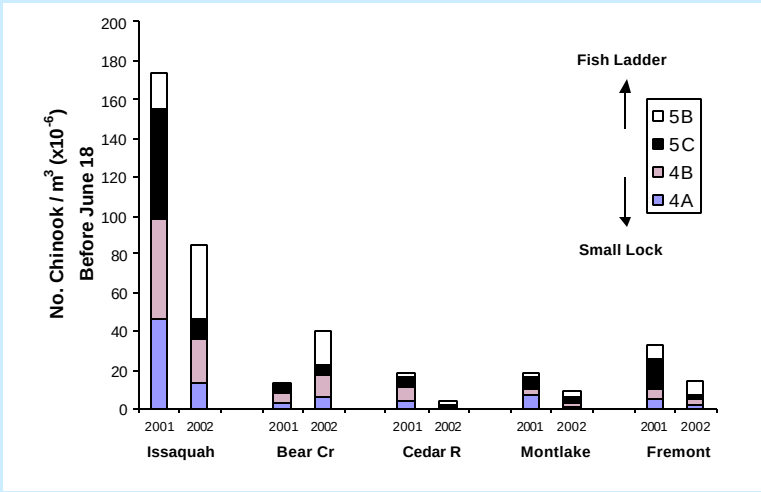
Surface Water Temperatures: Near Locks



Subaru Desert:

(with apologies to Marc Reisner…)

Flume Volumes & Chinook Passage Efficiencies



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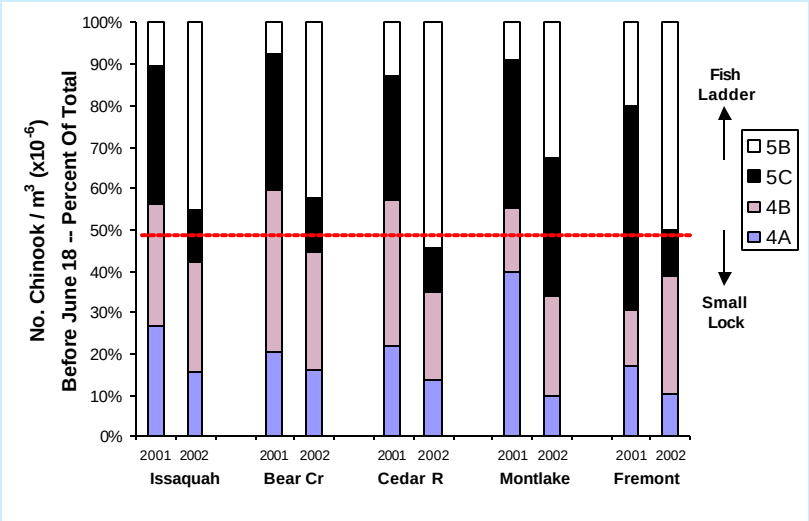

Workshop Focus Questions:

1. What Are We Pretty Sure About?

- Chinook Outmigrants Arrive Later In The LWSC And Locks Than Coho And Sockeye
- Passage Of Chinook Stocks Occurs ~ Same Dates In Given Year, Primarily During Daylight Hours
- Passage Timing Varies Annually, But Timing Variation Not Consistent Between Stocks
- Travel Distance And Travel Time In Basin Are Not Always Correlated
  - Migration Rates Vary Annually/Spatially
    - *e.g., 2002: Issaquah ˜ Cedar ? Bear*

1. What Are We Pretty Sure About?

- Chinook Outmigrants Pass Locks During Period That LWSC Water Temperatures Rise Above Tolerance Criteria
- Proportion Using Smolt Flumes Decreases With Time During Passage Season, Probably In Response To Surface Water Temperature
- Many Recycle Through Locks
  - Recycling Time Interval Decreases As Season Progresses
- Can Transition Rapidly To Salt Water (Salinities > 15 ppt), And Stay In Inner Bay Up To Three Weeks

2. What Are We Fairly Sure About?

- Migration Rate Of Natural-Origin Chinook Outmigrants Increases Slightly On Average As The Passage Season Progresses
- Some Smaller Juveniles Show Tendency To Remain In / Return To Lakes For Another Year (or Two) Of Residence
- There May Be Two (or Three) Year Classes That Outmigrate Through The Locks Each Year
- Chinook Outmigrants Do Not Pass Through Locks Immediately After Arrival

2. What Are We Fairly Sure About?

- Chinook Outmigrants Do Not Exhibit Significant Shoreline Affinity in LWSC *(collect more data)*
- Begin Passage at Locks in Connection With Lunar Phase (Apogee)
- May Be Induced By Lock Filling To Move Through Locks
- Natural-Origin Chinook Outmigrants May Spend Less Time Recycling
- Outmigrant Survival Appears to be High in LWSC
  - *(except possibly during disease outbreaks)*

3. What Are Biggest Uncertainties?

- Annual Differences In Migration Time Within Lake Wash. Basin May Reflect Lunar Phase Variation
- Water Temperature in LWSC May Be Strong Influence on Outmigration Characteristics
- Species Differences in Temperature Tolerance and Smolting Response May Influence Stock Status?
- Do Natural-Origin Chinook Smolts Spend Less Time In Inner Bay Than Hatchery Counterparts?
- Are There (Or Not) Delayed Effects of Passage Through LWSC & Locks on Saltwater Survival?
- Do Lock Operations Influence Passage Characteristics? *(e.g., Diurnal Variation)*